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Great Lakes Gill Net

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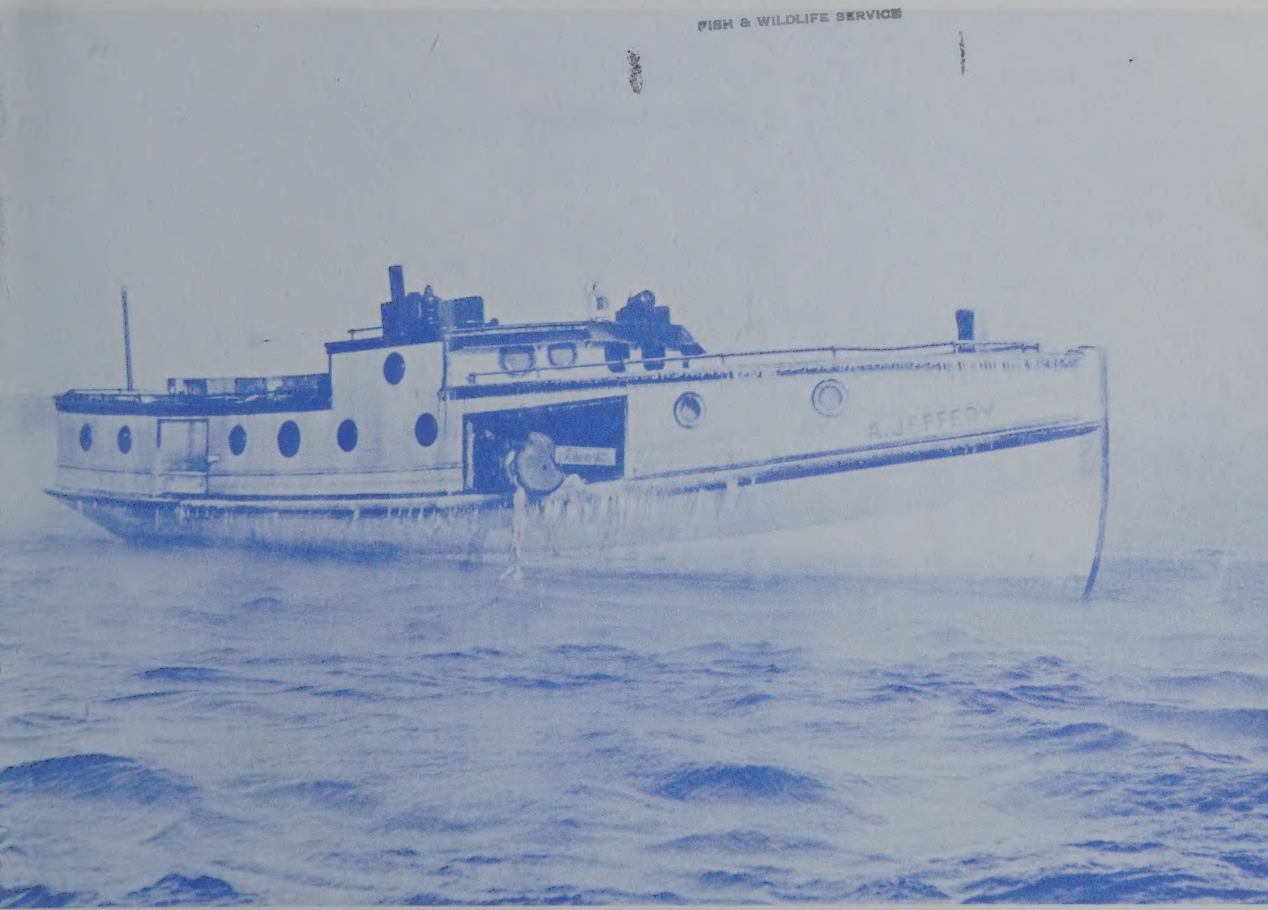

UNITED STATES DEPARTMENT OF THE INTERIOR
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Fishery Leaflet 606

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Great Lakes Gill Net

By

WILLIAM G. GORDON

FISHERY LEAFLET 606

Washington, D.C.
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Cover photo.–Typical Great Lakes gill net tug.

Great Lakes Gill Net

By

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ABSTRACT

This report on present methods of setting and retrieving gill nets in the Great Lakes has illustrations of equipment, techniques, and materials commonly used throughout the industry.

INTRODUCTION

The Great Lakes was an important fishing center long before the white man reached the area. Fish were the principal food for the Indians living near the shores of this vast internal waterway. As the white settlements grew, commercial fishing became an important industry. Today from the five principal Great Lakes, with a combined Canadian-United States area of 95,000 square miles, American fishermen produce about 60 million pounds of fish annually.

The basic characteristic of the fishery follows the original established trend of the small individual producers dispersed over a widespread area. Some 3,800 fishermen with over 1,600 boats make up what are known as day fisheries. Vessels up to 75 feet overall fish over comparatively short distances and return to port each night. The fishing season, generally 9 months long, often extends into winter when ice-free conditions prevail.

Most of the forms of gear and methods now used in the Great Lakes were well established by the late 1800's. In the 1920's, the deep trap net was added to the shallow trap net, gill net, pound net, set hooks, and seine. Since the early 1900's, the Great Lakes area has seen remarkable technological and industrial development. Although somewhat mechanized and modernized, the lakes fishing industry, in general, has not kept pace with other major fisheries.

Figure 1.–Map of the Great Lakes showing gill net fishing areas used by fishermen.

The gill net was one of the first gears introduced to the Great Lakes and still takes almost half the total annual catch. These nets are fished throughout the lakes in waters of 1 to 120 fathoms but are used principally in Lakes Superior, Huron, and Michigan, for catching chubs, lake herring, common whitefish, and yellow perch; and in Lake Erie, for yellow pike, yellow perch, common whitefish, and white bass (fig. 1). One reason for the popularity of the gill net is that it can be readily fished from small vessels with

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minimum investment in equipment. This report describes the present methods of setting and retrieving gill nets by Great Lakes fishermen.

VESSELS USED

The lake fisheries have been carried out by increasingly efficient vessels. At first, gill nets were fished from small open boats. With the coming of the traders, larger sailing vessels and small schooners were fitted out for fishing during 8 to 9 months when the lakes were fairly free of ice. With the advent of the steam engine and later the gasoline and diesel engines, a type of vessel known as the Great Lakes "tug" was gradually evolved (cover photo).

These vessels now range from 30-foot, two-man boats, to the 75-foot vessel with five-man crews, and are heavily built of steel or wood to withstand severe winter weather (Colvin 1960). Distinguishing features are the high closed-in superstructure with ports and hatches cut into the sides and stern for handling nets and lines. The vessels, of limited cruising range, generally operate within 30 miles of home port, to which they return each evening. Use of this particular type of vessel has extended the fishing season, because some of the larger vessels serve as ice breakers for smaller fishing crafts.

TWINE AND CORDAGE

The materials used in gill net construction vary from the small thread net fibers to the larger diameter anchor and buoy lines of cotton, linen, manila, and synthetic fibers. Synthetic fibers were introduced to the commercial fisheries following World War II. Various synthetic fibers of the polyamide group and other manmade fibers have revolutionized the fishing industry. Nylon[2] which was patented by the DuPont Chemical Company in 1934, has become the most popular fiber for gill net construction and has almost completely displaced natural fibers. Table 1 lists specifications for several materials used in Great Lakes gill net.

[2] Trade names referred to in this publication do not imply endorsement of commercial products.

Synthetic Twines

Multifilament nylon processed into threads is classified by the term denier, which is the weight in grams of 9,000 meters (29,538 feet) of a given yarn. Nylon twine is coded according to this standard direct system of measurement. Nylon twine for use in mesh of gill nets ranges from Nos. 34 to 693, but Nos. 34, 40, and 42 are widely used in the Great Lakes. An alternate system for classifying the larger nylon twine is to code with numbers corresponding to the same size of cotton twine, such as No. 6 thread and No. 9 thread. Segments of the Great Lakes fishing industry recently have used monofilament nylon gill netting. The single filament netting is coded according to diameter or breaking strength.

Molin (1959) discussed the results of comparative fishing tests in Swedish lakes with gill nets made of cotton, multifilament nylon, and monofilament nylon fibers. He reported that monofilament nylon nets caught more than seven times as many fish as cotton nets and about four times as many fish as multifilament nylon nets. The transparent nature of the single filament is believed to be the reason for the greater efficiency of the monofilament nylon set.

The drawbacks of monofilament are its stiffness, slightly higher cost, and unique construction. As the knots are either set by chemical action or secured with double knots, repairs on the net are more difficult than on the other types of nets. Some fishermen believe that the increased effectiveness of monofilament more than offsets the disadvantages.

Cordage

Float lines, lead lines, breast lines, cross bridles, and anchor and buoy lines are usually made of heavier cotton, manila, or synthetic twine and cordage, the smaller of which is called "maitre" cord.

Nylon nets are commonly hung to maitre cord of Nos. 96 to 120 thread. Recently, Dacron, Nylon, Polyethylene, and Polypropylene have increased in popularity and have largely replaced cordage of natural fibers. Anchor and buoy lines vary in size from one-quarter to one-half inch in diameter and may be of manila, Nylon, Polyethylene, or Polypropylene.

Mesh Size

Of the many methods of measuring mesh size, only the following are used in the Great Lakes area. Mesh size may be measured and defined in terms of

Table 1.–Specifications of materials commonly used in the construction of Great Lakes gill nets

Stabilized multifilament nylon				Monofilament nylon		Cotton		
Cord size	Construction	Length per lb. (thread)	Breaking strength	Twine no.	Breaking strength	Thread size	Length per lb.	Breaking strength
		Feet	*Pounds*		*Pounds*		*Feet*	*Pounds*
25/2	70 denier X2X2	38,559	4.2	3 MF	3	90/6 hawser	35,280	1.75
39/4	70 denier X4	38,559	4.2	4 MF	4	80/6 hawser	31,080	2.75
140/2	70 denier X2X2	38,559	4.2	7 MF	7	70/6 hawser	28,140	3.0
34/3	100 denier X3	35,640	4.4	9 MF	9	60/6 hawser	23,520	3.5
100/3	100 denier X3	35,640	4.4	22 MF	22	50/6 hawser	18,900	4.25
39/5	70 denier X5	30,900	5.2	34 MF	34	40/6 hawser	15,000	5.0
140/3	70 denier X2X3	26,256	6.4	55 MF	55	36/6 hawser	13,050	5.5
46/2	210 denier X2	26,256	7.0			30/6 cable	12,075	6.0
210/2	210 denier X2	26,256	7.0			20/6 cable	7,800	8.0
210/3	210 denier X3	17,460	10.3			20/9 cable	5,175	15.0

Nylon maitre cord				Nylon seaming twine				Nylon cordage		
Size No.	Length per lb.	Breaking strength	Approx. diameter	Size No.	Length per lb.	Breaking strength	Approx. diameter	Size	Length per lb.	Breaking strength
	Feet	*Pounds*	*Inch*		*Feet*	*Pounds*	*Inch*	*Inch*	*Feet*	*Pounds*
96	175	904	0.158	3	9,840	20	0.017	3/16	100	930
108	150	932	.166	4	6,360	26	.022	1/4	68	1,350
120	137	1,054	.170	5	4,740	42	.027	5/16	40	2,200
132	125	1,224	.187	6	3,750	52	.031	3/8	28	3,000
168	105	1,440	.205	7	3,024	63	.035	7/16	19	4,200
210	75	1,738	.230	8	2,640	74	.037	1/2	16	5,000
				9	2,244	84	.042			
				12	1,800	106	.046			
				15	1,500	126	.051			
				18	1,072	170	.058			
				21	860	210	.065			
				24	728	254	.073			
				30	630	295	.078			
				36	540	340	.085			
				42	486	372	.093			
				48	380	430	.103			
				60	295	558	.116			
				72	264	628	.125			
				84	218	772	.135			

bar (or square) and stretched (or extension) measure (fig. 2). Bar measure is the linear dimension of one side of the square mesh including one knot. Stretched measure is the distance between two opposite knots when under tension and may include one or both knots. Many State statutes provide for an "inside measure" and thus exclude the knots. The wetting, dyeing, or treatment of the gill nets may cause the twine to shrink or to stretch one-eighth of an inch or more. The amount of shrinkage or extension for

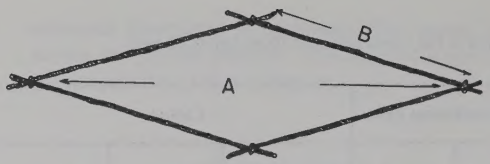

Figure 2.–Two methods for measure of mesh size.

various materials and the strains exerted on them while in use must be considered for efficient net construction.

Various mesh sizes are used throughout the fishery of the Great Lakes. Mesh sizes from 1-1/2- to 1-3/4-inch stretched measure are used in taking bait fish, smelt, and other small species. Mesh from 2-1/2- to 3-inch stretched measure are used mainly to catch lake herring, chubs, and yellow perch. Mesh of 4-1/2- to 6-inch stretched measure are used for lake trout, common whitefish, and yellow pike. Few nets have mesh sizes over 8 inches, and they are used principally for carp and lake sturgeon in some areas.

GILL NET CONSTRUCTION

The construction of Great Lakes gill nets varies with individual fishermen and the unique physical conditions of the individual lake. Factors such as depth of water, type of bottom, and habits of the species sought must be considered when constructing gill nets. Although wide variations exist in construction throughout the lakes, the same basic pattern is followed and a description of one would approximate most of them (fig. 3).

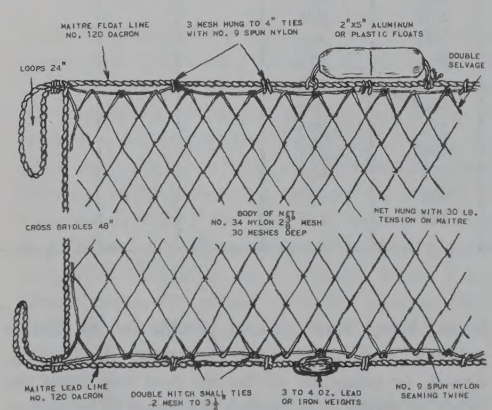
MAITRE FLOAT LINE NO. 120 DACRON
3 MESH HUNG TO 4" TIES WITH NO. 9 SPUN NYLON
2"x5" ALUMINUM OR PLASTIC FLOATS
LOOPS 24"
DOUBLE SELVAGE
CROSS BRIDLES 48"
BODY OF NET NO. 34 NYLON 2 3/8" MESH 30 MESHES DEEP
NET HUNG WITH 30 LB. TENSION ON MAITRE
MAITRE LEAD LINE NO. 120 DACRON
DOUBLE HITCH SMALL TIES 2 MESH TO 3 1/2"
3 TO 4 OZ. LEAD OR IRON WEIGHTS
NO. 9 SPUN NYLON SEAMING TWINE

Figure 3.–Construction of a typical nylon gill net.

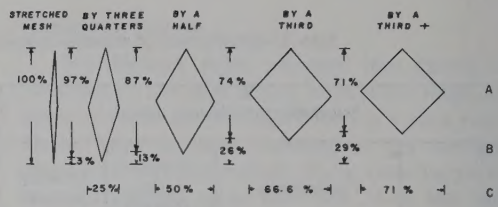

Figure 4.–Examples of the formation of mesh when hung to different bases.

The basic component is the strip of fine netting 20 to 100 meshes deep with double twine or selvage at top and bottom. Gill nets are frequently hung to maitre cord from a half to a third basis. This may also be expressed as being somewhere between 24 inches of mesh to 12 inches of maitre and 18 inches of mesh to 12 inches of maitre (fig. 4). The high efficiency of nylon and the tendency of nylon to entangle small fish has led many fishermen to hang gill nets much tighter or flatter; for example, less than 18 inches of mesh to 12 inches of maitre. The mesh also may be hung somewhat tighter at the ends of nets than in the body to reduce tangling and tearing of the mesh.

Seaming twine is used to hand the webbing to maitre cord. Although there is wide variation in practice among individual fishermen, the size of seaming twine would rarely exceed the equivalent of Nos. 9 or 12 thread cotton in size. At regular intervals, or phases, of 3 to 6 meshes, the double selvage is hung to the maitre with a knot similar to a clove hitch.

Wood, aluminum, or plastic floats are commonly attached to the maitre cord at regular intervals 6 to 8 feet along the float line (fig. 3). The size and spacing of floats are influenced by weights (leads) used at the bottom line. These weights are usually pipe leads or split leads ranging from 1 to 4 ounces in weight. Iron rings about 4 inches in diameter are sometimes used for weights on nets in Lakes Erie and Ontario.

Maitre cord extends around the entire net and is left in loop extensions at the four corners to permit joining of nets. Choice of length of individual nets vary with the fishermen and range from 100 to 600 feet. The nets are stored in net boxes, 3 to 4 feet by 2 feet by 12 inches, until set (fig. 5). A fishing unit known as a "gang" usually consists of 8 to 12 boxes of gill nets. At each end of the "gang" a short bridle of one-quarter inch or larger manila or synthetic rope is attached to the maitre loop of the net. This bridle, varying in length with choice of the fisherman and depth of water, is attached to an anchor and buoy

Figure 5.–Nets packed in boxes prior to setting.

line of one-quarter to one-half inch diameter rope. Chains are commonly used as anchors for bottom nets throughout the upper Great Lakes. Double or four-fluked anchors (fig. 6 and 7) are used generally

Figure 6.–Double-fluked gill net anchor.

Figure 7.–Four-fluked gill net anchor.

in Lakes Erie and Ontario. Buoys (metal, wood, or plastic) are attached with an identifying pole and flag marker at each end of the "gang" (fig. 8).

FISHING OPERATIONS

In normal fishing operations the gill net vessel may keep 2 to 5 or more gangs of nets in the water at one time, rotating the lifting and setting with spare gear aboard the boat, while other nets ashore are being repaired and drying. As fish caught in gill nets often suffocate and spoil, water temperature must be

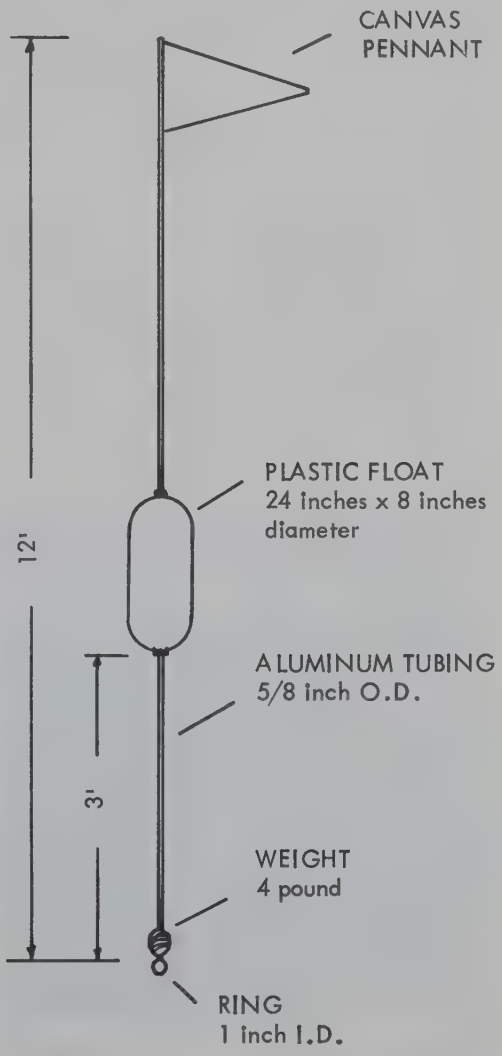

Figure 8.–Specifications for a marker buoy.

considered when the captain decides on the amount of gill net to be set. In areas where water temperatures of 65°to 78°F. commonly occur during summer, nets must be tended daily to reduce loss of fish quality. In colder waters, as much as 20 miles of gill net may be fished by a single vessel that lifts 8 to 10 miles of nets per day. Daily catches usually range from 100 to 3,000 pounds. Larger catches are made during spring and fall spawning seasons when fish are more concentrated.

Setting the Gill Nets

The tugs may set gill nets anywhere from shallow inshore shoals to deeper waters 50 miles or more from the fishing port. The setting of gill nets usually follows some pattern determined by the tug captain and by conditions on the fishing grounds. In typical operations, when the fishing area and depth have been selected, a marker and anchor are thrown overboard. Once the anchor is set, the vessel moves ahead in a predetermined direction at 3 to 5 knots. The nets are guided into the water either through the hands or over a roller (fig. 9) located at the stern door. Nets may be set parallel to the shore, at some angle to the shore, or in combinations of these. Often in attempts to "lead" fish, gill nets may be set at right angles to each other with one crossing over the top of another. For some species of fish the nets may be "canned" or floated with metal or plastic floats connected to vertical support or drop lines at predetermined distances below the surface. The distance above the bottom in deep water may be

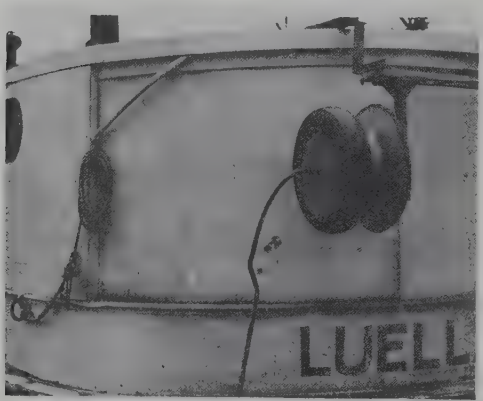

Figure 9.–Roller arrangement at stern door for setting gill nets.

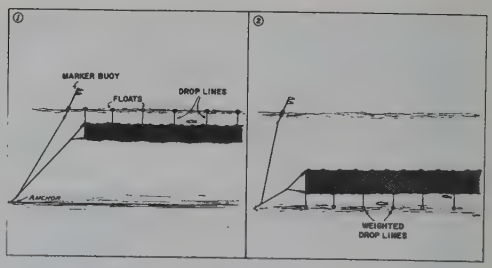

Figure 10.–Methods by which nets may be fished at midwater levels.

regulated by the length of weighted drop lines attached to the lead line (fig. 10). The end buoy and anchor, similar to that used at the beginning of the set, are thrown overboard and released after a stretch is exerted on the gang of nets. During the winter, a buoy may be attached midway in the gang of nets. This serves as insurance in the event the other buoys are carried away by high winds and ice.

Lifting the Gill Nets

When the gill net tug returns to the area where the nets were set during the preceding day or days, the skipper maneuvers the vessel to the downwind buoy. The buoy is brought aboard, and the anchor is hoisted aboard with the net lifter. Next, the net is brought aboard over an outboard roller supported at the rail and started through the gill net lifter. The lead line and float line are placed in a groove around a variable speed rotating head with cam-operated gripping lugs (fig. 11).

Figure 11.–Retrieving gill nets with variable speed net lifter.

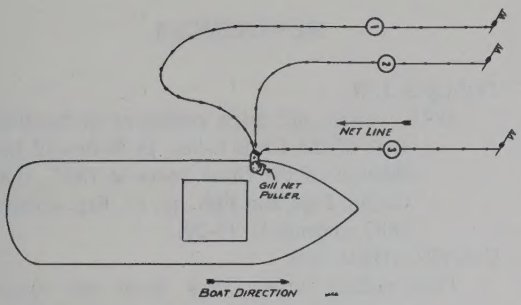

Figure 12.–Several methods of lifting nets aboard large gill net vessel.

The net lifters are installed to permit lifting the net from a curve or blight trailing slightly aft while running the boat parallel to the net (fig. 12). This method assists in reducing strain on the income net when the vessel surges and facilitates boat handling. In shallow waters where the loop system might allow the slack net to snag on the bottom, the net is hauled over the bow in such a way that the lifter assists in moving the boat forward as the gear is run down. While the net is retrieved, the crew remove the fish from the meshes, sort them to size and species, and place them in boxes or bins (fig. 13). When the catch is large, as may happen during spawning season, the nets and fish are loaded into boxes. The fish are then removed from the nets on the trip to port or by extra help after the vessel arrives at home port.

When time and conditions permit, the fish may be gutted, washed, placed in wooden boxes, and iced by the time the vessel returns to port. The fish are usually not iced except during the summer because they are landed within a few hours after being removed from the nets.

After the fish are removed, the nets are either reset in the fishing area or packed in boxes and taken ashore. If the wet nets are taken ashore, they are placed on reels to permit drying, repairing, and removing of debris.

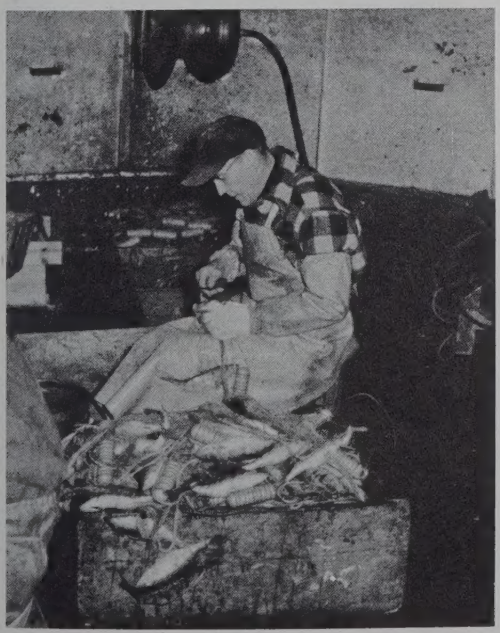

Figure 13.–Removing fish from the gill nets aboard vessel.

CARE OF NETS

Although preservation is not required on nylon nets, some treatment is often used such as a dyeing or cleansing agent. At regular intervals of from 2 to 14 days, each gang of nets is dipped in a soap solution or hot water to kill accumulated algae and bacteria. The gill net is spread on a large reel for repairing and untangling and is left to dry in a shady place until the next use (fig. 14). Two men are usually assigned to perform this task. The regular boat crew aids in the work when severe storms prevent fishing.

Figure 14.–Gill nets spread on reels for drying and repair.

TERMINOLOGY

An extensive synonymy of terms exists in the different Great Lakes fishing areas; however, it will be

of benefit to define the more important terms that have been used in this paper but not defined in the text.

The bight or curve refers to a trailing loop in a gill net as it is being retrieved from a set.

Cordage is a collective term for ropes, lines, and wires. Cordage is used to define the larger twines and maitre cord used to frame and anchor gill nets.

Gang, string, shot, shackle, and strap are terms to signify a specific set or section of nets. Gang commonly refers to eight boxes of gill nets measuring about 8,000 feet long.

Lead refers to the phenomenon where fish will follow netting or other underwater obstacles rather than attempt to swim through or over the object.

Lead line weights vary from 4 to 16 per pound and may be split or pipe leads. Spacing of weights and floats differs with choice of fishermen and area fished.

Maitre or hanging cord extends around the entire gill net. This cord forms the framework of the net; and floats, weights, and netting are fastened to this cord. Its size is usually designated by manufacturer's code numbers.

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